Chapter 2. Background

Description of the Stocks

The Nearshore Fisheries Management Act, which was chaptered at the same time as the Marine Life Management Act (MLMA), identified nine species of nearshore fish, and noted that nearshore fish "may include other species of finfish found primarily in rocky reef or kelp habitat in nearshore waters" [Fish and Game Code (FGC) §8586(A)]. The Act also provided an initial definition of nearshore waters as those waters within 1 nautical mile of land [FGC §8586]. In December 2000, the Fish and Game Commission used its authority under the Act and redefined nearshore waters to mean waters from the shoreline to a depth of 20 fm (120 ft) [California Code of Regulations (CCR), Title 14, §1.90(d)]. On the recommendation of the Department of Fish and Game, the Commission also added additional species to the list of nearshore fish, making 19 in all. Commercial and recreational fishermen take these 19 species in all water depths in which they occur.

The Department based its selection of the 19 species on an evaluation of 124 species that occur in coastal waters less than 40 fm deep. The evaluation of the species was based, in turn, on a set of criteria (Table 1.2-1) designed to indicate species most in need of management. Each criterion was evaluated on a scale of 0 to 3, with greater points demonstrating species in greater need of immediate attention. If no data were available for life history criterion (5, 6, and 7a-7e in Table 1.2-1), the species in question was given a rank of 1 for that criterion. A complete review of the evaluation is found in Appendix C.

The MLMA requires that fishery management plans include information about the species of fish under management, their natural history, habitats, and other matters (FGC §7080). The following descriptions summarize information on the 19 species of finfish that are the subject of the plan, with distribution maps for cabezon, California sheephead, monkeyface prickleback, and greenlings. More detailed descriptions are found in Appendix D .

Table 1.2-1. Nearshore species matrix showing ranking and criteria used to determine level of concern.

Fishery Criteria Life History Criteria Other Factors	brown rockfish	grass rockfish	gopher rockfish	China rockfish	olive rockfish	blackand-yellow rockfish	black rockfish	copper rockfish	California scorpionfish	blue rockfish	kelp greenling	quillback rockfish	California Sheephead	kelp rockfish	cabezon	monkey face eel (prickleback)	treefish rockfish	calico rockfish	rock greenling
1a – Changes in ex-vessel prices in the commercial fishery	3	3	2	3	3	3	1	2	1	2	3	1	2	2	3	2	0	0	0
1b – Rank in the sport fishery	3	2	3	3	3	2	3	3	3	3	3	2	2	2	3	1	2	2	2
2a – Increases in commercial landings	1	2	3	2	1	2	2	2	1	1	2	2	3	2	2	2	1	0	0
2b – Increases in sport landings	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3	0	0
3a – Decreases in commercial landings	3	0	1	1	1	0	1	0	2	1	0	0	0	1	0	0	0	0	0
3b – Decreases in sport landings	2	3	2	2	2	2	3	2	0	1	3	3	1	1	1	1	0	1	2
4 – Live fish take in the commercial fishery	2	2	2	2	1	2	1	1	3	1	3	1	1	2	3	2	1	0	0
5 – Special habitat need	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1
6 – Migrational vulnerability	3	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
7a – Susceptible to barotrauma on capture (no-0/yes-3)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7b – Removing larger, older individuals changes sex ratio of population (no-0/yes-3)	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
7c – Low fecundity as defined by having less than 100 embryos per spawning event (no-0/yes-3)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7d – Late maturation	1	1	1	1	2	1	2	2	0	2	1	2	1	1	1	1	1	1	1
7e – Longevity	3	3	3	3	3	3	3	3	3	3	2	3	3	3	2	2	1	2	1
8a – Special commercial harvest limitations	3	3	3	3	3	3	3	3	0	3	0	3	0	3	0	0	3	3	0
8b – Special sport harvest limitations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9 – Additive take	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1
TOTAL SCORE	30	23	24	24	23	22	23	22	22	21	21	21	20	21	19	16	16	12	9

Ranking was 0 to 3 with 0= lower ranking and 3 = higher ranking. For a more detailed analysis, see Appendix (D)

Black Rockfish, *Sebastes melanops*

Black rockfish are a minor to moderate component of nearshore commercial and recreational fisheries, with increasing importance from the San Francisco area northward.

<u>Distribution, Stock Structure and Migration</u>

Black rockfish range from Amchitka Island, Alaska to Santa Monica Bay in southern California, but are uncommon south of Santa Cruz. They frequently occur in loose schools 10-20 ft above shallow, rocky reefs (to 120ft), but individuals may also be observed resting on rocky bottoms, or schooling in mid-water over deeper reefs (to 240 ft) down to 1200 ft. Records for black rockfish show a range of movement/migratory patterns varying from residential (no movement) to transient (movement to 345 mi).

Age and Growth

In California, this species may attain a maximum length of 25.5 in., although individuals over 20 in. are rarely observed today. Average size observed in northern California commercial and recreational fisheries now is 14 to 15 in., while in central California average size is 11 to 13 in. Black rockfish have a relatively fast growth rate. First-year growth is usually 3.5 to 4.0 in. Most individuals become available to the fishery by the time they have reached 3 to 4 years of age and are approximately 10 to 11.5 in.

Reproduction, Fecundity and Seasonality

In California, age at first maturity for males is 3 yr, or 9.8 in. in total length (TL). For females, age at first maturity is 5 yr or, 11.8 in. At 6 yr, or about 14 in., half of all males are sexually mature. At 6 to 7 yr, or about 16 in., half of all females are sexually mature. As with all members of the genus *Sebaste*s, fertilization and development of embryos is internal. Black rockfish mating generally occurs between September and November. Females store the sperm internally until their eggs mature in December or January, at which time the eggs are fertilized. The larvae develop within 30 days. Larvae are spawned from late January to May, peaking in February off California. Larvae are planktonic for 3-6 months, and are dispersed by currents, advection, and upwelling. They begin to reappear as young-of-the-year fish in shallow, nearshore waters by May, but the major recruitment event usually occurs from July to August.

Natural Mortality

Mortality estimates have been calculated for black rockfish along the Pacific coast. The instantaneous rate of natural mortality has been found to vary between 0.2 and 0.4 for unsexed fish along the Pacific coast.

Diseases

No information is available on diseases in black rockfish.

Predator/Prey Relationships

As larvae, black rockfish feed on nauplii, invertebrate eggs and copepods. As adults, they remain primarily plankton-eaters, also feeding on small fishes (including juvenile blue and other rockfishes) as well as crustaceans, polychaetes, cephalopods, chaetognaths and jellyfish.

Competition

Black rockfish co-occur with blue and olive rockfishes in the water column and with black-and-yellow rockfish near and on the bottom. Black rockfish are commonly associated with other nearshore fish species, particularly other rockfishes. No other schooling rockfish is closely associated statistically with black rockfish, but three bottom-dwelling species, gopher, China, and brown rockfishes, showed an affinity to the same habitat and depth range as black rockfish. It is commonly known among fishermen that localized areas of relatively high abundance in the nearshore area characterize black rockfish distribution in central California.

Critical Habitat

Larval black rockfish are pelagic. Young-of-the-year (approximately 1.5 in.) settle nearshore, generally in the shallower portions of kelp beds (15 to 40 ft) where they frequent the sand-rock interface, seagrass beds, kelp canopy, mid-water column and high-relief rock. They have also been found on artificial reefs, and in bays, estuaries and tide pools. Adults inhabit the mid-water and pelagic areas over high-relief rocky reefs. They are found in and around kelp beds, boulder fields and artificial reefs.

Status of the Stocks

In California, no fishery-independent population estimates have been made of black rockfish stocks. Marine Recreational Fisheries Statistical Survey (MRFSS) showed that in Humboldt and Del Norte Counties (northern California), black rockfish comprised from 15 to 31 percent annually of the estimated total marine recreational catch for all fishing modes combined. South of the Eureka area, black rockfish gradually decrease in importance in the recreational catch and are infrequently observed south of Santa Cruz.

Black-and-Yellow Rockfish, *Sebastes chrysomelas*

Chrysomelas, which is Latin for “black and yellow”, describes the coloration of this species. They are black or dark brown with yellow blotches. Gopher rockfish, *Sebastes carnatus*, resemble them very closely, but gopher rockfish are brown or dark brown with large pink or whitish blotches. Both species are deep-bodied with large head spines.

Distribution, Stock Structure, and Migration

Black-and-yellow rockfish are distributed from Eureka, northern California to Isla San Natividad, central Baja California, but they are less common south of San Diego, California. They are bottom-dwelling, usually in water less than 60 ft, although they have also been found at depths up to 120 ft. They are a residential species with homing ability, and they inhabit kelp beds and rocky reefs. After establishing

residence, the adults are highly territorial and travel no more than 2 km from their home range.

Age and Growth

Whole otoliths have been used to age this species to a maximum of 20 to 22 yr. Based on a calculated age-length relationship, an 8-in. TL black-and-yellow rockfish is approximately 3-4 yr old, a 10-in. fish is approximately 6 yr old, and a 12-in. fish is 10-11 yr old. The maximum recorded total length of this species is 15.4 in.

Reproduction, Fecundity, and Seasonality

In central and northern California waters, males and females reach first maturity at 3 yr old, possibly as old as 4 yr for males and 6 yr for females. Corresponding total lengths range from 5.1 to 9.4 in. for males, and 5.3 to 9.6 in. for females. Fifty percent of the male population will reach maturity at 3 yr old, between 5.1 and 6.5 in TL, while half of the female population will reach first maturity between 5.3 and 6.3 in. TL, at 3 or 4 yr old. Spawning occurs off California from February through the end of July, with a peak spawning in February and March. Female black-and-yellow rockfish may be carrying fertilized eggs anytime between October and the end of February. In central California, June is the primary month of first appearance of young-of-the-year in kelp bed areas, and they are usually first observed in the kelp canopy.

Natural Mortality

Estimates of natural mortality are not available for black-and-yellow rockfish.

Diseases

No information is available regarding diseases in this species.

Predator/Prey Relationships

Adult black-and-yellow rockfish are nocturnal feeders, ambushing their prey between dusk and dawn. Predators of the adults include sharks, dolphins, and seals, while juveniles are prey of birds, porpoises, and fishes, including rockfishes, lingcod, cabezon, and salmon.

Competition

Black-and-yellow rockfish probably compete for food and space with gopher rockfish. When both species are present, the more aggressive black-and-yellow rockfish exclude gopher rockfish from shallower depths.

Critical Habitat

Larvae and young juveniles are pelagic, but the juveniles will eventually become demersal and settle on nearshore rocky areas or in kelp forests. Among the nearshore rockfishes, this species and grass rockfish have the most shallow depth distributions.

Status of the Stocks

No formal stock assessments have been made for this species.

Blue Rockfish, *Sebastes mystinus*

The blue rockfish is a medium-sized, midwater rockfish important in both the recreational and commercial catches in California, and it is the most abundant rockfish in central California kelp beds.

Distribution, Stock Structure, and Migration

Blue rockfish range from the Bering Sea to Punta Banda, Baja California, and from surface waters to a maximum depth of 1,800 ft. They are less common south of the northern Channel Islands and north of Eureka, California. It is believed that the last exceptionally strong year class of blue rockfish in central California occurred in 1988. No information is available regarding genetically-discernable sub-stocks of blue rockfish. Movement and migration studies of blue rockfish have determined them to be residential. Most authors report movement of less than 6 mi. In addition, tagging studies of adult blue rockfish indicate they do not migrate laterally along the coast. While studies show adult blue rockfish populations are more or less discreet at each fishing port, it is not known how much larval drift occurs between fishing areas.

Age and Growth

Blue rockfish, sex unspecified, have been aged to a maximum of 24 yr using scales or otoliths. Rockfish in general are considered to be slow-growing fishes, but blue rockfish are among the faster growing rockfish species. First year growth may vary from 3.0 to 4.5 in., and after 2 yr blue rockfish may reach 6 in. Anglers may catch an occasional 2- or 3-yr old blue rockfish, but most do not recruit to the sport and commercial fisheries until 4 to 7 yr of age when they range from 8 to 10 in. Females grow at a slightly faster rate than males.

Reproduction, Fecundity and Seasonality

Age at first maturity for males has been found to vary between 3 yr (7.5 in. TL) and 4 yr (9.0 in. TL). For females, age at first maturity has been found to vary between 2 yr and 5 yr. Fifty percent of males become mature between 3 yr and 7 yr (10.2 in. TL). For 50% of females, age at maturity has varied from 4 yr to 6 yr (11.4 in. TL). Studies in central California have shown that male gonads increase in size from May to July, but female eggs begin maturing from July to October. Mating takes place in October, but embryos do not begin to develop until December when the eggs are fertilized by the stored sperm. Embryos develop within the female, and the larvae release usually peaks in mid-January. Blue rockfish are thought to spawn once a year. Larvae are planktonic for 4-5 months, where they may be carried many miles by ocean

currents. Young-of-the-year blue rockfish begin to appear in the kelp canopy and shallow rocky areas by late April or early May when they are about 1.2 to 1.4 in. long.

Natural Mortality

The instantaneous rate of natural mortality has been reported as averaging 0.006, with a range of 0.001 to 0.008, using catch curve analysis.

Predator/Prey Relationships

Feeding habits vary considerably depending upon life history stage, depth, and locality. As larvae, blue rockfish eat plankton and are known to feed on nauplii and invertebrate eggs as well as copepods. As adults they remain primarily plankton-eaters. They feed on jellyfish, tunicates, thaliaceans, algae, small crustaceans, and small fish. Adults are subject to predation by other rockfish, lingcod, sharks, dolphins, seals, sea lions, and possibly river otters. Juveniles fall prey to other rockfishes, lingcod, cabezon, salmon, marine birds and porpoises.

Competition

Blue rockfish are commonly associated with other nearshore fish species, particularly other rockfishes. In a broad area along the entire Monterey Peninsula extending out to 240 feet deep, blue rockfish were the predominant species and were in close association with olive, yellowtail, starry, and rosy rockfishes.

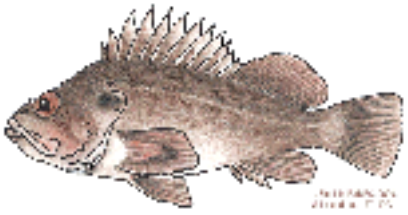
Critical Habitat

Larval blue rockfish are free-swimming. In the spring, young-of-the-year blue rockfish begin to appear in the kelp canopy, shallow rocky areas and nearshore sand-rock interfaces. Adults inhabit the mid-water and pelagic areas around high-relief rocky reefs, within and around the kelp canopy and around artificial reefs. They are common in kelp beds, where food is plentiful and protection from predators is provided. In the kelp beds, they form both loose and compact aggregations.

Status of Stocks

Commercial and recreational fishery sampling seem to suggest that while blue rockfish have withstood considerable fishing pressure over the last four decades, the stock continues to be healthy. They are one of the most important recreational species in California for anglers fishing from skiffs and Commercial Passenger Fishing Vessels, and are usually the most frequently-caught rockfish north of Point Conception. This species truly has been the bread and butter of the nearshore recreational angler in northern and central California.

Brown Rockfish, *Sebastes auriculatus*



Brown rockfish are a common nearshore rockfish species in California. As their name implies, they are brown in color with darker brown mottling.

Distribution, Stock Structure, and Migration

Brown rockfish are found along the Pacific coast of North America from southeast Alaska to Hipolito Bay, central Baja California. They live in shallow waters and bays, and have been found as deep as 420 ft, although they are primarily found in waters less than 175 ft. Both young and adult brown rockfish are residential, although they may migrate into deeper water in the winter. Brown rockfish have a home range and tagging studies generally show no movement, or movement of less than 2 km, although one tagging study showed a brown rockfish moving more than 50 km.

Age and Growth

Brown rockfish live less than 25 yr, which is a relatively short life span compared to other members of the genus. The maximum size for an adult is 22 in. There does not appear to be sexual dimorphism between male and female brown rockfish in relation to length, weight, or age.

Reproduction, Fecundity, and Seasonality

Male and female brown rockfish mature from 3 to 10 yr of age, measuring 7.5 in. and 15 in., respectively. Half of the population is mature at 5 yr of age, measuring about 10 in. As with all members of the genus *Sebaste*s, brown rockfish give birth to live young. Larvae are released from the female in December and January, and may also be released in May and June. Larvae live in the upper zooplankton layer for a month and then metamorphose into free-swimming juveniles. These open ocean juveniles spend 3-6 months in the water column. As they grow older, they settle in shallow water nearshore and then migrate to deeper water. Young-of-the-year fish commonly migrate into bays and estuaries which they use as a nursery habitat. The use of the bay as a nursery is an uncommon practice for rockfish species. They may remain in the bay around rocks, piers and other structures in areas of higher salinity for 1-2 years before returning to the open coast. San Francisco Bay appears to be an important habitat for juvenile brown rockfish.

Natural Mortality

A natural mortality rate was calculated at 0.112 for brown rockfish from Puget Sound, Washington.

Disease

No information on disease in brown rockfish was found.

Predator/Prey Relationships

As brown rockfish grow, they feed on increasingly larger prey. As juveniles they feed on small crustaceans, amphipods, and copepods, but at approximately 5 in. they

shift to eating crabs and small fish. Birds, dolphins, seals, sharks, lingcod, cabezon, and salmon have been observed to feed on juvenile and adult brown rockfish.

Competition

There is no information available on brown rockfish competitors.

Critical Habitat

Brown rockfish are typically found in association with sand-rock interfaces and rocky bottoms of artificial and natural reefs over a fairly wide depth range, and in eelgrass beds. In shallow waters, they are associated with rocky areas and kelp beds, while in deeper waters they stay near the rocky bottom. Juveniles migrate into both high- and low-relief reefs and are strongly attached to their home sites.

Status of Stocks

Brown rockfish have long been an important component of the marine recreational fishery and a relatively minor but important component of the nearshore commercial fishery in California, especially north of Point Conception. While there have been studies of local abundance in certain coastal areas and within bays, the population size and structure of this species has not been comprehensively assessed. The brown rockfish has been identified as a species vulnerable to severe localized depletions in other areas; in Washington state, the Puget Sound stock of brown rockfish was recommended for listing as a threatened species in 1999.

Cabezon, *Scorpaenichthys marmoratus*

The cabezon is the largest member of the Cottid family. In Spanish *cabezon* means big-headed or stubborn, and proportionally, the massive head is the largest feature of this fish. The specific name *marmoratus* refers to the marbled or mottled appearance of the body, which can be reddish, greenish, or bronze.

Distribution, Stock Structure, and Migration

Populations range along the eastern Pacific coast from Point Abreojos, Baja California to Sitka, Alaska (Figure 1.2-1). Cabezon normally occur nearshore and their depth range extends from the intertidal to 335 ft. As fish get older and larger they tend to migrate into deeper water. In shallower water they migrate with the tide to feed.

Age and Growth

Cabezon have been aged to a maximum age of 17 yr for males and 16 yr for females. Total lengths corresponding to these ages were 25.5 in. and 28.5 in., respectively. The largest recorded size is 39 in. in length and over 25 lb.

Reproduction, Fecundity, and Seasonality

Limited information available on age at sexual maturity suggests that in central California males begin to mature in their third year and all are mature by their fourth year. The smallest mature male cabezon observed measured from 13.3 to 13.5 in. TL, and the smallest mature female cabezon observed measured 17.5 in. TL. Some females begin to mature in their fourth year between 15 and 20 in. in length, and by the sixth year all females are sexually mature. In California, spawning commences in late October, peaks in January

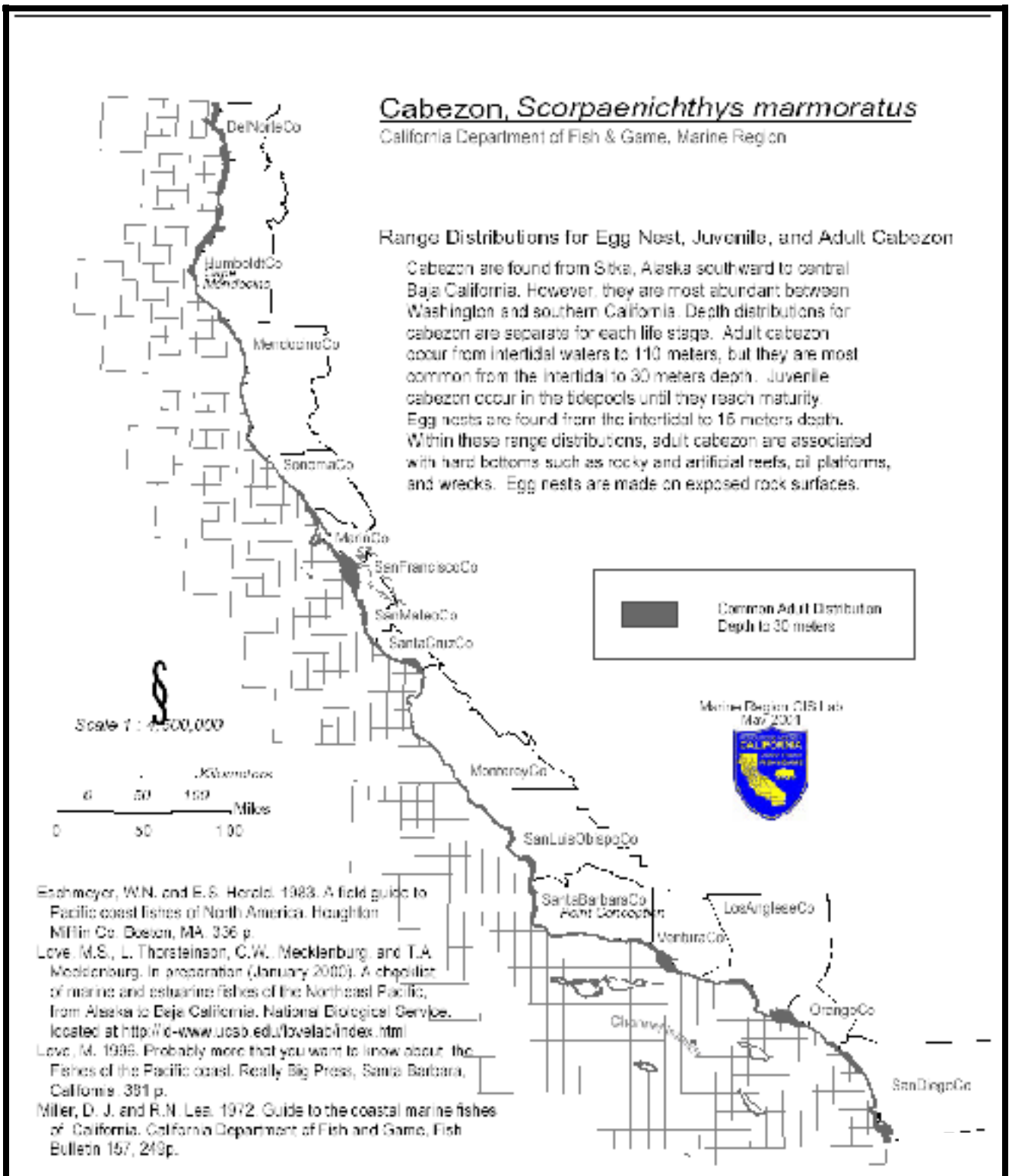


Figure 1.2-1. Range distributions for egg nest, juvenile, and adult cabezon

and continues until March. Females lay or spawn eggs on intertidal and subtidal, algae-free rocky surfaces, primarily in crevices and under rocks. Masses of the pale green or reddish eggs are up to18 in. in diameter and as much as 2-4 in. thick. Males fertilize the eggs after spawning, and the male guards the nest during the 2-3 week maturation period. Fish are very protective of the nests for the 2-3 weeks it takes the eggs to develop and hatch. Larvae are approximately 0.1 to 0.2 in. long at hatching and begin to settle out of the plankton at 0.6 to 0.9 in.

Natural Mortality

Estimates of natural mortality are not available for cabezon.

Diseases

No information is available concerning diseases in cabezon.

Predator/Prey Relationships

Cabezon can be aptly described as "sit and wait" predators. Their mottled coloration lets them blend in with their surroundings as they sit motionless to wait for their next meal. With large, robust pectoral fins set low on the body and a powerful tail, they quickly lunge after unwary prey, engulfing it in their large mouths. Adult fish eat crabs, small lobsters, mollusks (abalone, squid, octopi), small fish (including rockfishes), and fish eggs. Juveniles are taken by rockfishes and larger cabezon, as well as by lingcod and other sculpins.

Competition

Based on co-occurrence with adult and juvenile cabezon, demersal fishes associated with kelp beds and reef structure likely to compete with cabezon for food and space include lingcod, greenlings, and rockfish species such as grass, gopher, black-and-yellow, China, quillback, copper, and vermilion.

Critical Habitat

Cabezon frequent subtidal habitats in or around rocky reef areas and under kelp beds. Usually solitary, juveniles and adults both are common on any rocky bottom area with dense algal growth. They are often in the vicinity of kelp beds, jetties, isolated rocky reefs or pinnacles, and in shallow tide pools. Most of their time is spent sitting in holes, on reefs, in pools, or on kelp blades beneath the canopy, but not actively swimming.

Status of the Stocks

Limited information is available on population biology or changes in biomass over time.

Calico Rockfish, *Sebastes dallii*

The calico rockfish is a small, colorful rockfish species that does not exceed 10 in. in length or 2 lb in weight.

Distribution, Stock Structure, and Migration

Calico rockfish range from Sebastian Viscaino Bay, Baja California to San Francisco. They inhabit a depth range of 60 to 840 ft.

Age and Growth

Calico rockfish have been aged to a maximum of 11-12 yr.

Reproduction, Fecundity, and Seasonality

Male calico rockfish first become sexually mature at age 7. Female calico rockfish become sexually mature at age 9. Spawning occurs in southern California between January and May, with peak spawning occurring in February. Fertilized eggs are present in November and December. The larval stage lasts from less than 4 weeks to 2 months.

Natural Mortality

Estimates for natural mortality were not available for calico rockfish.

Diseases

No information is available on diseases in calico rockfish.

Predator/Prey Relationships

Juvenile calico rockfish feed on zooplankton such as copepods, barnacle cyprids, and larval fish. Adults feed on larger crustaceans such as euphausiids, fishes, and cephalopods. Larger rockfish species, lingcod, cabezon, and salmon prey upon adult calico rockfish. Sea birds and dolphins have also been known to feed on calico rockfish.

Competition

Calico rockfish probably compete with other foraging rockfish species and other finfishes with similar food habits.

Critical Habitat

Juvenile calico rockfish are found in areas of soft sand-silt sediment, and on artificial reefs. Adult calico rockfish inhabit rocky shelf areas where there is a mud-rock or sand-mud interface with fine sediments. They are associated with areas of high and low relief, including artificial reefs.

Status of the Stocks

There are currently no estimates of abundance for calico rockfish in California. Because of the relatively small size of adult calico rockfish, they are not usually targeted by either sport or commercial fishermen, but are caught incidentally when

other finfish species are targeted. Calico rockfish frequently appear as bycatch in ridgeback prawn trawls in southern California, and are caught by sport anglers on Commercial Passenger Fishing Vessels (CPFVs) and private boats as anglers fish for other, larger bottom-dwelling species.

China Rockfish, *Sebastes nebulosus*

The China rockfish is almost entirely black except for a yellow, or yellow-white stripe that runs from the anterior portion of the dorsal fin, along the lateral line, to the tail.

Distribution, Stock Structure, and Migration

China rockfish occur from Kachemak Bay, northern Gulf of Alaska to Redondo Beach and San Miguel Island in southern California, but they are most abundant from southeastern Alaska to Sonoma County, California. They are found at depths of up to 420 ft, but are most common between 30 and 300 ft. The juveniles travel freely, but the adults are sedentary, associated with rocky reefs or cobble. They are residential, staying within a home range, and are generally found resting on the bottom or hiding in crevices.

Age and Growth

China rockfish have been aged to a maximum age of 26 yr. Based on a calculated age-length relationship, a 10-in. TL China rockfish is approximately 6-7 yr old and a 12-in. TL fish is approximately 9-10 yr old. A maximum length of 17.9 in. has been recorded for this species.

Reproduction, Fecundity, and Seasonality

Off central and northern California, male China rockfish reach reproductive maturity at a total length of 10.2 in. and 3 yr of age, while the females reach maturity at 11.0 in. TL and 4 yr of age. Fifty percent of the population of males and females will reach first maturity at 10.6 in. TL and 4 yr of age, and 11.0 in. TL and at 4 yr of age, respectively. Spawning occurs off central and northern California between January and July, with peak spawning in January. Individual China rockfish spawn once a year. Larvae settle out of the plankton 1-2 months after release.

Natural Mortality

Estimates for natural mortality are not available for China rockfish.

Diseases

No information is available on diseases in China rockfish.

Predator/Prey Relationships

Like grass and kelp rockfish larvae, China rockfish larvae feed on plankton. Juveniles eat crustaceans, while the adults eat crustaceans as well as ophiuroids,

mollusks, and fish. Juveniles are prey of birds, porpoises, and fishes, including rockfishes, lingcod, cabezon, and salmon. Predators of adult China rockfish include sharks, dolphins, seals, lingcod, and possibly river otters.

Competition

China rockfish are likely to compete with other demersal species like kelp greenling, cabezon, lingcod, and other rockfishes such as grass, quillback, copper, and vermilion, all of which also inhabit rocky areas.

Critical Habitat

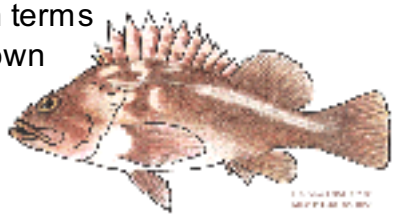
Larvae and early juveniles are pelagic but larger juveniles and adults settle on rocky reefs or cobble substrate, most commonly in depths between 30 and 300 ft. Once they settle, individuals may stay on the same reef for years.

Status of the Stocks

No formal stock assessment has been completed for this species.

Copper Rockfish, *Sebastes caurinus*

The copper rockfish is a highly variable species in terms of coloration, and due to this characteristic has been known by several names, depending to some degree upon locality.



Distribution, Stock Structure, and Migration

The copper rockfish is broadly distributed, known from the northern Gulf of Alaska to off central Baja California. It also has a broad bathymetric distribution, and is known to occur from the shallow subtidal to 600 ft. Tagging studies indicate that copper rockfish, for the most part, show little movement once they have settled to the bottom. Movement of up to one mile has been noted but the majority of tagged and recaptured copper rockfish are recaptured at the locality where they were originally taken. This life-history characteristic of high site fidelity makes this species susceptible to local depletion.

Age and Growth

Copper rockfish have been aged to 41 yr. Off central California, copper rockfish have been aged to 28 yr (a 22.1-in. individual). Size at age for copper rockfish, based on aging whole otoliths, from central California for the first 5 yr is as follows: age 0, to 3.6 in. TL; age 1, 3.7 to 5.9 in. TL; age 2, 4.2 to 9.4 in. TL; age 3, 7.0 to 11.5 in. TL; and age 4, 8.9 to 13.2 in. TL. There appears to be no significant difference in the growth rates between sexes. The maximum-recorded length for copper rockfish is 22.8 in.

Reproduction, Fecundity, and Seasonality

Length at first maturity for males has been found to vary from 11.6 to 14.6 in. TL (3 to 8 yr, respectively), and for females 11.6 to 12.2 in. TL (approximately 5 yr). Length at 50% maturity for males has been documented at 12.6 in. (4 yr), and for females at 13.4 in. (6 yr). As with all rockfishes, this species gives birth to live young. Copper rockfish produce prodigious amounts of young. Mating occurs in the fall, and in California larvae are released during the winter months (Jan.-Apr.) with a peak in February. Larval duration was found to be one to two months. Young-of-the-year copper rockfish recruit into the nearshore environment at about 0.8 to 1.0 in. during April and May off central California.

Natural Mortality

Calculations of natural mortality have been made from populations in Puget Sound, Washington at 0.1127 using tag/recapture method on fish 5 to 34 yr old.

Diseases

No information is available on diseases in copper rockfish.

Predator/Prey Relationships

Copper rockfish feed on a wide variety of prey items. Juvenile copper rockfish feed primarily on planktonic crustaceans. Larger crustaceans form a major part of their diet as they grow; these include *Cancer* sp. crabs, kelp crabs, and shrimps. Squid of the genus *Loligo* and octopi are also important food items. Fishes, which include young-of-the-year rockfishes, cusk-eels, eelpouts, and sculpins, are important forage for larger individuals. As juveniles and adults, copper rockfish are preyed upon by a variety of fishes including other rockfishes, lingcod, cabezon and salmon as well as several species of birds and mammals.

Competition

No information on competition for copper rockfish was found. Due to their co-occurrence with other large bottom-dwelling fish species such as cabezon, lingcod, greenlings, and rockfishes such as vermilion, brown, China, and gopher, it is likely that some degree of competition for food and space may occur.

Critical Habitat

Newly-recruited copper rockfish initially associate with surface-forming kelp. After several months, and at about 1.6 in., the juveniles settle to the bottom on rocky reefs as well as sandy areas and are referred to as benthic juveniles. Adults are commonly found in kelp bed areas but also frequent deeper rocky reefs. As adults, this species is considered to normally occur slightly above the substrate, which is often high-relief rocky shelf and rock-sand interface. Copper rockfish are an important component of the nearshore rocky reef system and are frequently encountered by scuba divers in this environment. Submersible observations of the biotic community off the Big Sur coast revealed copper rockfish between depths of 72 and 322 ft. The

majority of sightings were of individual (solitary) fish occurring over rocky reefs or boulder fields and most frequently in areas of high relief. Occasionally an individual was observed over sand.

Status of the Stocks

There has been no stock assessment of this species in California. However, there is compelling evidence that copper rockfish populations have severely declined in many areas and large individuals are noticeably less common than in past decades. Copper rockfish is one of the species taken in the commercial live-fish fishery. Copper rockfish have been an important component of the recreational catch in both skiff and CPFV fisheries, especially off central and northern California. Due to its relatively large size, copper rockfish have been considered one of the premium species in the recreational angler's catch and a prime target for the sport diver. Due to their solitary nature, high habitat specificity, and the size they enter the fishery (as juveniles), the copper rockfish is a prime candidate for local depletion.

Gopher Rockfish, *Sebastes carnatus*

Carnatus, a Latin word for "flesh-colored", describes the coloring of gopher rockfish, which are brown or dark brown with large pink to whitish blotches.

Distribution, Stock Structure, and Migration

Gopher rockfish range from Eureka, California to San Roque, central Baja California, but they are most common from about Mendocino County, California to Santa Monica Bay. Larvae and young juveniles are pelagic, but as the juveniles mature, they settle on rocky reefs or into the kelp canopy. Adults are residential and bottom-dwelling, associated with kelp beds or rocky reefs, from the intertidal to about 264 ft, most commonly between 30 and 120 ft depths.

Age and Growth

Maximum age estimates from northern and central California range from 24 to 30 yr. Based on a calculated age-length relationship for aging, an 8-in. TL gopher rockfish is approximately 3-4 yr old, a 10-in. TL fish is approximately 5-6 yr old, and a 12-in. fish is approximately 9-10 yr old. Their greatest recorded size is 15.7 in. in length.

Reproduction, Fecundity, and Seasonality

In southern California waters, both males and females reach first maturity at 3 yr and 5.3 in. TL. Off central and northern California, half of the population of males, as well as females, will reach maturity at 4 yr, 6.7 in. TL. By 10 yr and 9 in. TL, the entire population of males will have reached reproductive maturity. Off California, spawning takes place between January and July, with peak spawning in February, March and May. It may take up to 90 days, at a range of 0.8 to 1.6 in. TL, before the larvae settle

out of the plankton. In central California, June has been observed to be the primary month for recruitment of larvae to nearshore areas.

Natural Mortality

There are no estimates of natural mortality for gopher rockfish.

Diseases

No information is available on diseases in gopher rockfish.

Predator/Prey Relationships

Gopher rockfish larvae feed on plankton during daylight hours. Juveniles also feed during the day, and eat crustaceans. Their predators include fish, such as rockfishes, lingcod, cabezon, and salmon, as well as birds and porpoises. Adult gopher rockfish are nocturnal predators that ambush their prey. Some of their prey items include crustaceans (particularly *Cancer* sp. crabs, caridean shrimp, and anomurans), fish (including juvenile rockfish), and mollusks. Their predators include sharks, dolphins, and seals.

Competition

The territorial gopher rockfish excludes kelp rockfish from bottom territories and black-and-yellow rockfish from the deeper portions of its vertical distribution. Also, based on co-occurrence, gopher rockfish probably competes for food and space with cabezon, lingcod, greenlings, and other rockfish species including China, quillback, copper, and vermilion.

Critical Habitat

Small juveniles may inhabit the kelp canopy. Larger juveniles and adults are bottom dwellers and prefer shallow rocky substrate and kelp beds, as well as sandy areas near reefs, usually between 30 and 120 ft depths.

Status of the Stocks

No formal stock assessments have been completed for gopher rockfish. This species is a valuable component of recreational and commercial fisheries in California.

Grass Rockfish, *Sebastes rastrelliger*

Grass rockfish are green with black or gray mottling, somewhat resembling kelp rockfish except that kelp rockfish are usually brown or gray-brown.

Distribution, Stock Structure, and Migration

Grass rockfish are found from Yaquina Bay, Oregon to Bahia Playa Maria, central Baja California, although they are most common from northern California south. This is a shallow water species, commonly found from the intertidal to 20 ft, but they have also been found to depths of 150 ft. As juveniles they

are pelagic, but as they mature and become adults, they become associated with kelp beds and reefs. This species is considered residential, and stays within a their home range.

Age and Growth

Grass rockfish have been aged to a maximum of 23 yr. Based on a calculated age-length relationship, an 11.5-in. TL grass rockfish is approximately 5 yr old, a 16-in. TL fish is approximately 10 yr old, and an 18-in. TL fish is approximately 14 yr old. Maximum length recorded for this species is 22 in.

Reproduction, Fecundity, and Seasonality

Male and female grass rockfish reach first maturity at different lengths and ages. First maturity in males is considered to be 8.7 in. TL at a corresponding age of 2 yr off the coast of southern California, whereas the smallest mature male observed measured 14.1 in. TL and was 8 yr of age off central California. First maturity in females is considered to be 8.7 in. TL (age undetermined) off the coast of southern California, whereas the smallest mature female observed measured 12.8 in. TL and was 5 yr of age off central California. It was also determined that fifty percent of the males reached maturity at 9.6 in. TL and 3.5 yr of age, and half of the females reached maturity at 9.4 in. TL and 3.7 yr of age. In California waters, spawning takes place between November and March with peak spawning in January and February. At birth, the larvae are between 0.17 and 0.18 in. SL and after 2 months, when they settle out of the plankton, they are about 1.1 in. in length. Young-of-the-year first appear in shallow waters between spring and summer.

Natural Mortality

Estimates of natural mortality are not available for this species.

Diseases

No information is available on diseases in grass rockfish.

Predator/Prey Relationships

Larval grass rockfish are daytime feeders, but as adults they feed at night. Juveniles and adults prey upon crustaceans, but the adults also eat other fish (such as juvenile surfperches and midshipmen). Predators of juveniles include birds, porpoises, and fishes, including rockfishes, lingcod, cabezon, and salmon. The adults are the prey of sharks, dolphins, and seals.

Competition

Grass rockfish, commonly occurring in kelp beds and reef structures, may compete for space and food with other bottom-dwelling fishes common to these habitats such as cabezon, lingcod, greenlings, and other rockfish such as gopher,

black-and-yellow, China, quillback, copper, and vermilion. Among rockfishes, they share a fairly narrow depth distribution primarily with the black-and-yellow rockfish.

Critical Habitat

Grass rockfish are a shallow water species, most commonly found from the intertidal to 20 ft, but usually only the juveniles are found in tide pools. Among rockfishes, they have one of the shallowest and relatively narrow depth ranges. They are found in vegetated areas, particularly in kelp beds, and around reef structures where the adults may be found hiding in crevices.

Status of the Stocks

No formal stock assessment has been done for this species. Grass rockfish are taken in substantial numbers by finfish traps and commercial hook-and-line, particularly in central California. Grass rockfish are also taken in large numbers by spear fishermen and are also common for shore, pier, and small vessel recreational fishermen. Among recreational fishing modes, they are relatively more important to anglers fishing from shore than those fishing from boats.

Kelp Greenling, *Hexagrammos decagrammus*, and Rock Greenling, *Hexagrammos lagocephalus*

Kelp Greenling (male)

Rock Greenling

The kelp greenling is in the family of Hexagrammidae and shares this taxonomic relationship with lingcod. The kelp greenling is one of the most conspicuous fishes in rocky nearshore habitats, occurring often in and around kelp beds. The male and female look so different that they were first described as separate species. The body color is variable in both sexes, ranging from light gray to brown. Males, however, have large irregular blue patches anteriorly, while females are uniformly covered with smaller dark spots.

The rock greenling is in the family Hexagrammidae and is closely related to the kelp greenling, both taxonomically and morphologically. It is reddish-brown with darker mottling and often has large bright-red blotches on the sides. The inside of the mouth is bluish.

Distribution, Stock Structure, and Migration

Kelp greenling populations range along the eastern Pacific coast from La Jolla, California to the Aleutian Islands in Alaska (Figure 1.2-2). Kelp greenlings are not known to migrate; on the contrary, adults are often territorial, particularly during spawning season.

The rock greenling ranges from the Bering Sea to Point Conception, but also occurs in the western Pacific Ocean south to Japan. In California, this species is

infrequently observed south of San Francisco (Figure 1.2-3). Little is known about their stock structure. Similar to kelp greenling, adults are territorial.

Age and Growth

Kelp greenlings grow faster than most nearshore fishes during their first 3 years. They have been aged to a maximum of 8 yr for males and 13 yr for females. Total lengths corresponding to the male and female ages were 15.0 in. and 17.4 in., respectively. The greatest recorded size is 21 in. TL.

No data on rock greenlings are available from California. Rock greenlings have been aged to a maximum of 8 yr for males and 11 yr for females. Total lengths corresponding to these male and female ages were 11.9 in. and 22.4 in., respectively.

Reproduction, Fecundity, and Seasonality

Approximately one third of all male kelp greenling are sexually mature at age 2, while half of all males are mature by age 3-4 at an average total length of 11.6 in. Approximately one-half to two-thirds of all female kelp greenling are sexually mature at age 3-4 at an average total length of 11.6 in. In California, the spawning season for kelp greenling occurs from September through December. Females spawn their eggs subtidally on rocks. Their egg nests have been observed at depths of 16 to 56 feet. An individual male kelp greenling may guard up to 11 egg masses simultaneously, although the average number is four. Hatching occurs from December through February in northern California. Larvae are approximately 0.3 to 0.4 in. long at hatching and remain as planktonic organisms up to a total length of 2.0 to 2.7 in.

No data are available from California on rock greenling. However, data from the western Pacific Ocean indicate that approximately one half of all male and female rock greenlings are sexually mature at age 3-4 and a length of 11.4 to 13.8 in. In the Aleutian Islands, the spawning season extends from June through August. Females lay eggs, and it is unknown whether rock greenling guard their nests.

Natural Mortality

Estimates of natural mortality are not available for kelp greenling or rock greenling.

Diseases

No information is available concerning diseases in kelp greenling or rock greenling.

Predator/Prey Relationships

Kelp greenling larvae prey on a wide variety of planktonic organisms, including fish larvae and eggs. During most of the year, juveniles and adults consume a variety of prey that is consistently available in the habitat, including crabs, shrimp, snails, chiton, abalones, octopi, fish, fish eggs, and algae. There are brief periods when organisms such as juvenile fishes or herring spawn become exceptionally abundant,

and kelp greenling shift their food habits to take advantage of these opportunities. The primary predators of adult greenling are lingcod and harbor seals.

No information is available from California on prey of larval rock greenling. No information is available on predators of non-larval rock greenling.

Competition

Based on co-occurrence with adult and juvenile kelp greenling, bottom-dwelling fishes associated with kelp beds and reef structure likely to compete with kelp greenling for food and space include lingcod, cabezon, and rockfish species such as grass, gopher, black-and-yellow, China, quillback, copper, and vermilion.

On the same basis, bottom-dwelling fishes likely to compete with rock greenling for food and space include lingcod, cabezon, kelp greenling, and rockfish species such as grass, China, quillback, copper, and vermilion.

Critical Habitat

Kelp greenling range in depth from the intertidal to approximately 500 ft, but are more common at depths of 150 ft or less. Fish frequent subtidal habitats in or around rocky reef areas and under kelp beds. Juveniles and adults both are common on any rocky bottom area with dense algal growth.

Juvenile and adult rock greenling frequent sub-tidal habitats in or around rocky reef areas and in kelp beds.

Status of the Stocks

There are no estimates of abundance for kelp greenling or rock greenling in California.

Kelp Rockfish, *Sebastes atrovirens*

The coloring of kelp rockfish varies in hue from tan to pinkish brown to red, with dark mottling.

Distribution, Stock Structure, and Migration

Kelp rockfish live in kelp beds and on rocky reefs, ranging from Timber Cove, northern California to Punta San Pablo, central Baja California. They are, however, most abundant between northern Baja and central California. This species is known to occur at depths up to 150 ft but are most common between 15 and 50 ft. Kelp rockfish are residential species, and make no migrations except possibly into deeper water during winter storms.

Age and Growth

Kelp rockfish have been aged to a maximum of 20 yr. Based on a calculated age-length relationship, an 8-in. TL kelp rockfish is approximately 3 yr old, an 11.6-in. fish is approximately 6 yr old, and a 13-in. fish is approximately 9 yr old. The greatest recorded length for this species is 16.7 in.

Reproduction, Fecundity, and Seasonality

Male and female kelp rockfish reach maturity at 4 and 5 yr of age, respectively. Corresponding total lengths at maturation are 9.9 in. and 9.6 in. Off central California, spawning takes place between December and June, with peak spawning in May, and fertilized eggs are present between December and January. Females give birth to live young, and the planktonic larvae are 0.16 to 0.17 in. in standard length (SL) at birth. Kelp rockfish larvae settle into the kelp canopy after 1 to 2 months. As juveniles, they will settle out of their pelagic phase and first appear in the kelp beds between April and August. Recruitment to the nearshore area in central California generally occurs during June and July.

Natural Mortality

Estimates of natural mortality are not available for this species.

Diseases

No information is available on diseases in kelp rockfish.

Predator/Prey Relationships

Juvenile and adult kelp rockfish are believed to search for their prey, although adults are also known to ambush their prey. Prominent prey items for adults and juveniles include crustaceans such as shrimp and amphipods, and small fish, particularly juvenile blue rockfish. The juveniles are prey for birds, pinnipeds, porpoises, lingcod, cabezon, salmon, and other rockfish. Predators of adult kelp rockfish include sharks, dolphins, and seals.

Competition

The kelp rockfish is excluded from bottom areas of kelp beds by the territorial gopher rockfish.

Critical Habitat

Kelp rockfish occur in rocky reef and artificial reef areas, but most commonly in kelp beds. They spend their days drifting within kelp blades, sometimes upside down or resting on them. They are more active at night, leaving the kelp beds to hunt prey.

Status of the Stocks

Local abundances have been studied for the kelp rockfish, however there is no comprehensive stock assessment throughout their range. This species is often taken in sport fisheries, such as spear fishing, but they are also taken in small numbers by commercial hook-and-line and traps. Their restricted habitat and limited movements make them highly exploitable. Therefore, local depressions probably occur in areas where diving, skiff fishing, or commercial fishing is concentrated.

Monkeyface Prickleback, *Cebidichthys violaceus*

The monkeyface prickleback is not a true eel, and in the late 1980s it was reclassified to the prickleback family. The coloration is a uniform light brown to black with two characteristic dark stripes below each eye. The coloration of both sexes is similar.

Distribution, Stock Structure, and Migration

Populations range along the eastern Pacific coast from San Quintin Bay, Baja California to southern Oregon. They normally occur nearshore and their depth range extends from the intertidal to 80 ft. They are considered to be a residential species and exhibit only small movements from under rocks to foraging sites.

Age and Growth

Monkeyface pricklebacks have relatively slower growth rates than most fishes. They have been aged to a maximum of 18 years. The largest recorded size is 30 in. TL.

Reproduction, Fecundity, and Seasonality

Information available on age at sexual maturity suggests that in California both sexes begin to mature in their third or fourth year at a total length of 11.0 to 14.2 in., while 50% maturity occurs at approximately 15.4 in. at five yr of age. Fertilized eggs are present in females and spawning activity occurs from January to May, while the peak spawning period is February to April. Females spawn their eggs on subtidal, rocky surfaces. Nest guarding behavior has been observed, but it is unclear if males, females or both sexes guard eggs.

Natural Mortality

Estimates of natural mortality are not available.

Diseases

No information is available on diseases in monkeyface pricklebacks.

Predator/Prey Relationships

The diet of monkeyface pricklebacks varies from carnivorous to omnivorous to herbivorous, depending on life history stage and time of year. Prey items of early juveniles are predominantly zooplankton. Adults prefer annual red and green algal species. Predators of monkeyface pricklebacks include piscivorous birds such as great egrets and red-breasted mergansers, and fishes such as cabezon and grass rockfish.

Competition

Other crevice-dwelling fishes such as the black prickleback, high cockscomb and gunnels, such as the rockweed gunnel, may compete with the monkeyface prickleback for space and resources.

Critical Habitat

Typical habitat for monkeyface pricklebacks includes rocky areas with ample crevices, including high and low intertidal tide pools, jetties and breakwaters, and relatively shallow subtidal areas, particularly kelp beds. Juveniles are particularly adapted for the high intertidal area, and this species has air-breathing capabilities.

Status of the Stocks

No information is available on the status of stocks of monkeyface prickleback.

Olive Rockfish, *Sebastes serranoide*s

Olive rockfish are one of several nearshore *Sebastes* associated primarily with the mid-water region of kelp forest of the California coast. They are streamlined fish with very few head spines. Their body color is dark brown or dark green-brown on the back and light brown or green-brown on the sides.

Distribution, Stock Structure, and Migration

Olive rockfish occur from southern Oregon to Islas San Benitos (central Baja California) from surface waters to 570 ft. They are common from about Cape Mendocino to Santa Barbara and around the northern Channel Islands from surface waters to about 396 ft. Tagging studies have found that olive rockfish move relatively little, ranging less than 1 mi. This species has been variously described as transient or residential.

Age and Growth

Ageing studies show olive rockfish maximum age is at least 25 yr. Females grow larger than males and, beginning at maturation, tend to be longer at a given age. The maximum reported length of olive rockfish is 24 in. This is one of the fastest-

growing nearshore rockfishes. Based on whole otoliths, a 10-in. TL fish is approximately 2-3 yr old, a 15-in. TL fish is approximately 10 yr old, and an 18-in. TL fish is approximately 10 yr old.

Reproduction, Fecundity, and Seasonality

Throughout California, males mature at a somewhat smaller size and a slightly greater age than females; however, the difference is not large. First maturity for males ranges from 10.6 in. (no age given) to 12.6 in. (4 yr). First maturity for females ranges from 11.2 in. (no age given) to 12.6 in. (4 yr). Fifty percent maturity for males occurs between 12.6 and 13.0 in. (both 5 yr), while 50% maturity for females occurs between 13.4 in.(4 yr) and 13.8 in. (5 yr). Mating occurs in the fall, and females release larvae once a year in the winter from December through March, peaking in January. Larvae are planktonic for 3 to 6 months, then from April to September young-of-the-year olive rockfish, around 1.2 -1.6 in. long, settle out of the plankton.

Natural Mortality

No information was found on natural (or fishing) mortality of olive rockfish.

Diseases

No information is available concerning diseases in olive rockfish.

Predator/Prey Relationships

Juvenile olive rockfish feed on crustaceans, juvenile fishes, polychaetes, octopi and squid. Juveniles become more active at night, but it is not clear whether adults are nocturnal: they do feed commonly on octopi, which are more available at night. Adult olive rockfish feed on fish (especially juvenile rockfishes), small crustaceans, polychaetes, cephalopods and tunicates. Adults are preyed upon by sharks, dolphins, and pinnipeds such as seals and sea lions. Juveniles fall prey to other rockfishes, lingcod, cabezon, salmon, albacore, birds, and porpoise.

Competition

Olive rockfish are known to compete with the kelp bass *Paralabrax clathratu*s for food and shelter in southern and central California where their ranges overlap. Though olive rockfish have been associated with surfperches and bocaccio, and are frequently observed among schooling blue rockfish, no information on competition among them was found.

Critical Habitat

As with all rockfishes, the larval stage of olive rockfish is planktonic. When young-of-the-year olive rockfish settle out of the plankton they are most commonly found in and around kelp beds, oil platforms, surfgrass and other structures at depths as shallow as 10 ft. Sub-adult and adults live over high-relief reefs, as well as in mid-

water around oil platforms. In shallow waters, they are found throughout the water column in and around kelp beds, and are known to rest on the bottom as well.

The movement patterns of olive rockfish may be limited by the presence or absence of kelp beds. It has been shown that the abundance of olive rockfish decreases as beds of *Macrocystis* kelp are removed.

Status of the Stocks

There has been no stock assessment of this species. However, there is clear evidence from sport fish catch records that olive rockfish have declined in abundance south of Point Conception.

Quillback Rockfish, *Sebastes maliger*

The quillback rockfish is a component of central and northern California's nearshore sea floor assemblage. Quillback rockfish are stoutly built, a characteristic common among nearshore *Sebastes* found in close association with the bottom. They are usually orange-brown to black with a yellow or orange pale area between the eye and pectoral fin.

Distribution, Stock Structure, and Migration

Quillback rockfish are known from the Gulf of Alaska to San Miguel Island in southern California. They are considered common between southeast Alaska and northern California. They are considered a shallow- to moderate-depth species although they occur rarely at depths of 900 ft. No stock structure has been determined for quillback rockfish in California. Like other *Sebastes* that inhabit shallow, benthic habitat, individual quillback rockfish are not known to travel far. Tagging studies in central California and Washington have shown quillback to be residential (no movement other than diurnal) or show movement of less than 6 mi. They have also demonstrated homing ability and specific diurnal movement patterns.

Age and Growth

In California, quillback rockfish have been aged to 15 yr, but are known to live longer: they have been aged to 76 yr in Canada. Quillback rockfish can grow to 24 in.

Reproduction, Fecundity, and Seasonality

In California, size at first maturity as well as 50% maturity for males is 8.7 in. TL (4 yr.), and for females is 10.2 in. TL (6 yr). As with all *Sebastes*, quillback rockfish have internal fertilization and give birth to live young. In California, mating takes place in the late winter/early spring, and the young are born April through July; with a peak in May and June. After roughly 1 or 2 months in the plankton, they begin to settle near shore.

Natural Mortality

Natural mortality values have been calculated for quillback rockfish stocks in Washington. It has been calculated to be 0.1253 via tag and recapture methods, and 0.115 via survivorship/age frequency curve.

Diseases

No information on disease in quillback rockfish was found.

Predator/Prey Relationships

As planktonic larvae, quillback rockfish are known to consume nauplii, invertebrate eggs and copepods. After they settle in the shallow, nearshore areas they continue this feeding pattern and feed on crustaceans. As adults they are known to feed on a variety of bottom-dwelling prey such as crustaceans; small fish, including rockfishes and flatfishes; bivalves and fish eggs. As juveniles, they are preyed upon by fishes, including larger rockfishes (such as yelloweye), lingcod, cabezon and salmon. Various marine birds and pinnipeds take juvenile quillback as well. Adults are also subject to predation by larger fish-eating fishes including some sharks, as well as pinnipeds and possibly river otters.

Competition

Though quillback rockfish occur with a host of other nearshore bottom-dwelling species, no information on competition was found.

Critical Habitat

The larvae of quillback rockfish are planktonic. After about 1-2 months in the plankton, they begin to settle near shore. Young-of-the-year quillbacks are found among relatively shallow, low-relief rocky substrate and shallow, vegetated habitats such as kelp and eelgrass beds. Juveniles tend to inhabit the very nearshore sea floor as well, and are found over both low and high rocky substrate. Adults are most often found in deeper water and are solitary reef-dwellers living in close association with the bottom. They are often seen perched on rocks or taking shelter in crevices and holes. Adults have also been noted to retreat to eelgrass beds at night. Quillback are also associated with the rock-sand interface, but are rarely seen in the open away from suitable cover.

Status of the Stocks

No stock assessment has been done for this species. Quillback rockfish are a minor component of the nearshore recreational fishery with decreasing occurrence in central and southern California. They are also a component of the nearshore commercial fishery.

California Scorpionfish, *Scorpaena guttata*

California scorpionfish are easily distinguished from most other California fishes. They are a relatively heavy-bodied species, with strong head and

fin spines, ranging in color from red to brown, often with purple blotches and always covered with dark spots. Scorpionfish are a nocturnal species. The sharp spines on the dorsal, anal and pelvic fins are poisonous.

Distribution, Stock Structure, and Migration

Scorpionfish are found from Santa Cruz, California south along the Pacific coast of Baja California and into the Gulf of California. Preferring warmer water, this species is common as far north as Santa Barbara. Scorpionfish live in tide pools and to depths of about 600 ft. Scorpionfish tagging studies have shown individuals to travel as far as 350 km. Some of these movements are related to annual spawning migrations, which are sometimes extensive.

Age and Growth

California scorpionfish grow to 17 in. and some live to at least 21 yr. After 4 yr of age, females grow faster than males and reach a larger size.

Reproduction, Fecundity, and Seasonality

Although a few scorpionfish mature at 6 in. (1 yr), over 50% are mature by 7 in. (2 yr) and all reproduce by 9 in. (4 yr). They have separate sexes, and females generally outnumber males. Spawning occurs from April to September, peaking in June and July. Scorpionfish are oviparous, have external fertilization, and females produce eggs imbedded in the gelatinous walls of hollow, pear-shaped “egg balloons”. The egg masses float near the surface and the eggs hatch within 5 days. California scorpionfish make extensive spawning migrations in late spring and early summer, when most adults move to 12-360 ft depths, forming large spawning aggregations on or near the bottom. During spawning, these aggregations rise up off the bottom, sometimes approaching the surface. Spawning occurs in the same areas year after year.

Natural Mortality

No natural mortality estimates are available for the scorpionfish.

Diseases

No information is available on diseases in this species.

Predator/Prey Relationships

Scorpionfish are a carnivorous, ambush predator. Small crabs are probably the most important food of the scorpionfish. They are primarily nocturnal and feed at night. Octopi prey on small individuals.

Competition

No information on competitors of adult or juvenile scorpionfish is available.

Critical Habitat

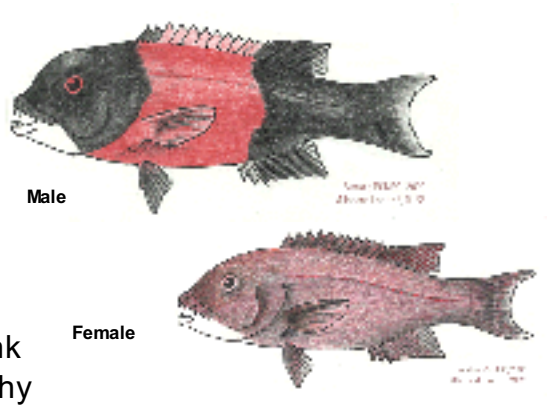
Very young scorpionfish live in shallow water, hidden away in habitats with dense algae and bottom-encrusting organisms. Juveniles and adults are most abundant on hard bottom (such as rocky reefs, sewer pipes and wrecks).

Status of the Stocks

No population estimates exist for California scorpionfish. However, data from trawl studies show that there are substantial short-term fluctuations in California scorpionfish abundance within the Southern California Bight.

California Sheephead, *Semicossyphus pulcher*

The California sheephead is easily distinguished by its color pattern, great body depth, and large size. Juvenile sheephead (less than 4 in. long) are orange with at least two white, horizontal stripes on the side and several black spots in the dorsal and anal fins. Adult males have a black head and tail, separated by a reddish middle section, while the females are uniformly pink or reddish. The males also have a prominent, fleshy bump on their foreheads.



Distribution, Stock Structure, and Migration

California sheephead range from Monterey Bay, California south into the Gulf of California (Figure 1.2-4). This species is not common north of Point Conception. Sheephead are found from intertidal areas to about 280 ft depths. They are considered a resident, solitary species and no systematic movements have been described.

Age and Growth

Male sheephead have been aged at around 50 yr, and can achieve a length of 3 ft and a weight exceeding 36 lb. Females have been aged to 30 years.

Reproduction, Fecundity, and Seasonality

All sheephead are protogynous hemaphrodites, beginning life as females, but then older, larger females developing into males. Female sexual maturity may occur at 3 to 6 yr and fishes may remain female for as long as 15 yr. The timing of the transformation to males involves the population sex ratio as well as the size of available males. Sheephead are sometimes seen in large schools, perhaps associated with spawning aggregations. Batch spawning occurs between July and September. Larval drift ranges from 34-78 days. Settlement size is between 0.5 and 0.6 in.

Natural Mortality

Estimates of natural mortality are not available.

Diseases

No information is available on diseases in sheephead.

Predator/Prey Relationships

Sheephead feed by crushing their prey with enlarged jaw teeth. They have a broad diet which includes crabs, barnacles, mollusks, and sea urchins. Once they reach their large adult size, sheephead have few known predators. Giant sea bass, moray eels, and harbor seals have been documented as predators of sheephead.

Competition

Smaller sheephead may compete with garibaldi, *Hypsypops rubicundus*, for food.

Critical Habitat

Sheephead inhabit nearshore rocky reefs, kelp beds, and surfgrass beds. They seem to prefer areas of high and low relief, but have also been observed foraging over sandy bottom habitat. Sheephead are resident on many artificial reefs in southern California. At night they often utilize rock crevices and holes to sleep.

Status of the Stocks

There has been no ongoing analysis of the status of the California sheephead. With the exception of 1982-1983, the population seems to increase during El Niño conditions and this is reflected in recruitment.

Treefish, *Sebastes serriceps*

The treefish is a nearshore rockfish species that inhabits shallow, rocky habitats. They are striking in appearance: yellowish with five to six vertical black bars on the side.

Distribution, Stock Structure, and Migration

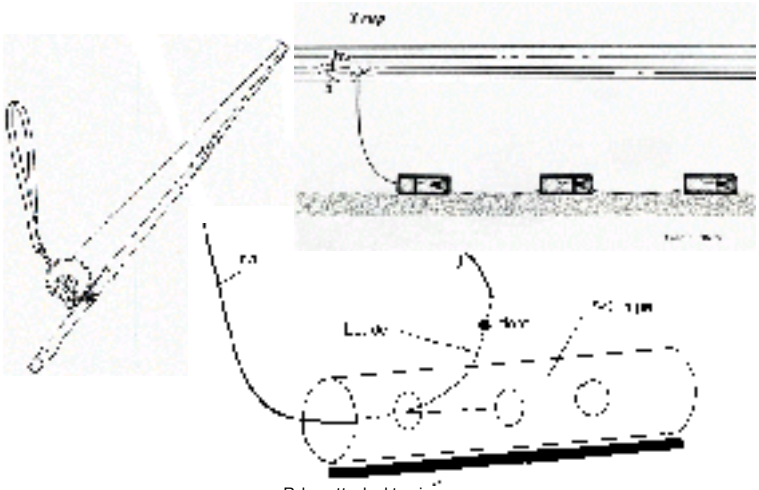
Treefish range from Cedros Island, Baja California to San Francisco. The depth range they inhabit is shallow to 150 ft. Treefish are a residential species with a limited home range; they do not exhibit migrational activity.

Age and Growth

The maximum size for treefish is 16 in. TL.

Reproduction, Fecundity, and Seasonality

No data are available for size at maturity for this species. Treefish are thought to spawn annually in late winter.



Rebar attached to pipe (inside or outside)

Each leader has to be attached directly to the line from the surface. In this example (only one leader is illustrated), the leader goes through a hole in the PVC pipe and is attached to the line that runs through the length of the inside of the pipe. Rebar can be attached either inside or outside of the PVC pipe to serve as an anchor

Natural Mortality

There is no information on treefish natural mortality.

Diseases

No information is available on diseases in treefish.

Predator/Prey Relationships

Treefish are ambush predators that feed nocturnally on benthic invertebrates, including mollusks and crustaceans, and small fish. Juveniles are fed upon by rockfishes, lingcod, cabezon, salmon, birds, porpoises, and least terns. Adults are preyed upon by sharks, dolphins, and seals.

Competition

Treefish are solitary and highly territorial. They may compete with other treefish and nearshore rockfish species such as gopher, grass, and black-and-yellow rockfishes for food and shelter habitat.

Critical Habitat

Juvenile treefish are found in drifting mats of kelp, in areas of high rocky relief, and on artificial reefs. Adult treefish are found on shallow rocky reefs, frequently in caves and crevices. They are also found in similar habitats on artificial reefs in southern California.

Status of the Stocks

There are no estimates of abundance for treefish in California. In southern California, treefish are an important species in both the nearshore recreational fishery and in the commercial fishery for live fish.

History and Socio-economics of the Fishery

To one degree or another, the different activities that focus on one or more of the 19 nearshore finfish species occur along the entire California coast (Figures 1.2-5, 1.2-6 and 1.2-7). Some activities such as commercial and recreational fishing are widespread, while others, such as scientific research or diving for observation of nearshore ecosystems, are confined to relatively few areas. The Nearshore Fishery Management Plan (NFMP) focuses upon commercial and recreational fisheries due to